

Questions 51 – 65 odd, 69 – 73 odd, 96, 109

$$51) \frac{2.00\text{L O}_2 \left| \begin{array}{c} 1 \text{ mol O}_2 \\ 22.4\text{L O}_2 \end{array} \right| \begin{array}{c} 4 \text{ mol Fe} \\ 3 \text{ mol O}_2 \end{array} \left| \begin{array}{c} 55.85 \text{ g Fe} \\ 1 \text{ mol Fe} \end{array} \right|}{1} = \mathbf{3.21 \text{ g Fe}}$$

$$53) \frac{70.0 \text{ L N}_2 \left| \begin{array}{c} 1 \text{ mol N}_2 \\ 22.4\text{L N}_2 \end{array} \right| \begin{array}{c} 2 \text{ mol NaN}_3 \\ 3 \text{ mol N}_2 \end{array} \left| \begin{array}{c} 65.02 \text{ g NaN}_3 \\ 1 \text{ mol NaN}_3 \end{array} \right|}{1} = \mathbf{135 \text{ g NaN}_3}$$

$$55) \frac{4800 \text{ m}^3 \text{ H}_2 \left(\frac{10 \text{ dm}}{1 \text{ m}} \right)^3 \left| \begin{array}{c} 1 \text{ L} \\ 1 \text{ dm}^3 \end{array} \right| \begin{array}{c} 80 \text{ L} \\ 100 \text{ L} \end{array} \left| \begin{array}{c} 1 \text{ mol H}_2 \\ 22.4\text{L H}_2 \end{array} \right| \begin{array}{c} 1 \text{ mol Fe} \\ 1 \text{ mol H}_2 \end{array} \left| \begin{array}{c} 55.85 \text{ g Fe} \\ 1 \text{ mol Fe} \end{array} \right|}{1} = \mathbf{1.5 \times 10^7 \text{ g Fe}}$$

$$\frac{1 \text{ mol H}_2\text{SO}_4 \left| \begin{array}{c} 98.09 \text{ g H}_2\text{SO}_4 \\ 1 \text{ mol H}_2\text{SO}_4 \end{array} \right| \begin{array}{c} 100 \text{ g solution} \\ 98 \text{ g H}_2\text{SO}_4 \end{array}}{1 \text{ mol H}_2} = \mathbf{2.6 \times 10^7 \text{ g H}_2\text{SO}_4}$$

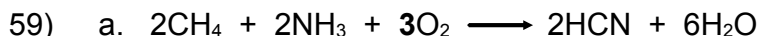
You will save time in the future if you remember that $1\text{m}^3 = 1000\text{L}$

$$57) \quad 2\text{CH}_3\text{OH} + 3\text{O}_2 \longrightarrow 2\text{CO}_2 + 4\text{H}_2\text{O}$$

$$\frac{50.0\text{mL CH}_3\text{OH} \left| \begin{array}{c} 0.85\text{g CH}_3\text{OH} \\ 1\text{mL CH}_3\text{OH} \end{array} \right| \begin{array}{c} 1 \text{ mol CH}_3\text{OH} \\ 32.04\text{g CH}_3\text{OH} \end{array}}{1} = 1.326 \text{ mol CH}_3\text{OH} / 2 = 0.663$$

$$\begin{aligned} PV &= nRT \\ (2.00) 22.8 &= n (.08206) (300.) \quad n = 1.852 \text{ mol O}_2 / 3 = 0.617 \\ &\quad \text{limiting reactant} \end{aligned}$$

$$\frac{1.852 \text{ mol O}_2 \left| \begin{array}{c} 4 \text{ mol H}_2\text{O} \\ 3 \text{ mol O}_2 \end{array} \right|}{1} = \mathbf{2.47 \text{ mol H}_2\text{O}}$$



Since we have equal amounts of all 3 reactants, O_2 is the limiting reactant.

$$\frac{20.0 \text{ L O}_2 \left| \begin{array}{c} 2 \text{ L HCN} \\ 3 \text{ L O}_2 \end{array} \right|}{1} = \mathbf{13.3 \text{ L HCN}}$$

$$61) \frac{3.164 \text{ g X}_2 \left| \begin{array}{c} 22.4 \text{ L X}_2 \\ 1 \text{ L X}_2 \end{array} \right| \begin{array}{c} 1 \text{ mol X}_2 \\ 70.87 \text{ g/mol X}_2 \end{array}}{1} = \frac{70.87 \text{ g/mol X}_2}{2} = \mathbf{35.44 \text{ g/mol X}} \quad \text{X = Chlorine}$$

63) To calculate density we first need volume. (Assume 1 mole)

$$\begin{aligned} PV &= nRT \\ (0.9802\text{atm}) V &= 1\text{mol} (0.08206) 333\text{K} \quad V = 27.88\text{L} \end{aligned}$$

$$D = \frac{\text{mass}}{\text{volume}} = \frac{352.0\text{g}}{27.88 \text{ L}} = \mathbf{12.6 \text{ g/L}}$$

$$65) \quad \frac{7.8 \text{ g CO}_2}{44.01 \text{ g CO}_2} \left| \frac{1 \text{ mol CO}_2}{1 \text{ mol CO}_2} \right| = 0.177 \text{ mol CO}_2$$

$$PV = nRT$$

$$P(4.0) = 0.177(0.08206)300$$

$$P = 1.1 \text{ atm}$$

With air at 740 torr, the partial pressure would be the same (1.1 atm)

$$P_{\text{total}} = P_{\text{CO}_2} + P_{\text{air}} = 1.1 \text{ atm} + .97 \text{ atm} = \mathbf{2.1 \text{ atm}}$$

$$69) \text{ a. } X_{\text{CH}_4} = \frac{0.175 \text{ atm}}{0.175 + 0.250 \text{ atm}} = 0.412 \quad X_{\text{O}_2} = 1 - 0.412 = 0.588$$

$$\text{b. } PV = nRT$$

$$(0.425 \text{ atm}) 10.5 \text{ L} = n(0.08206)338 \text{ K} \quad n = 0.161 \text{ mol}$$

$$\text{c. } n_{\text{CH}_4} = 0.412(0.161 \text{ mol}) = 0.0663 \text{ mol CH}_4 \left| \frac{16.042 \text{ g CH}_4}{1 \text{ mol CH}_4} \right| = 1.06 \text{ g CH}_4$$

$$n_{\text{O}_2} = 0.588(0.161 \text{ mol}) = 0.0947 \text{ mol O}_2 \left| \frac{32.00 \text{ g O}_2}{1 \text{ mol O}_2} \right| = 3.03 \text{ g O}_2$$

$$71) \text{ a. } P_{\text{H}_2} = 1.032 - 0.042 \text{ atm} = 0.990 \text{ atm}$$

$$\text{b. } PV = nRT$$

$$(0.990) 0.240 \text{ L} = n(0.08206)303 \text{ K}$$

$$n = 0.00956 \text{ mol H}_2$$

$$\frac{1 \text{ mol Zn}}{1 \text{ mol H}_2} \left| \frac{65.38 \text{ g Zn}}{1 \text{ mol Zn}} \right| = \mathbf{0.625 \text{ g Zn}}$$

$$\text{Zn} + 2\text{HCl} \longrightarrow \text{ZnCl}_2 + \text{H}_2$$

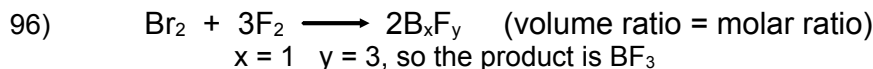
$$73) \quad P_{\text{O}_2} = 734 - 19.8 \text{ torr} = 714.2 \text{ torr} = 0.940 \text{ atm}$$

$$PV = nRT$$

$$(0.940) 0.0572 = n(0.08206)295$$

$$n = \frac{0.00222 \text{ mol O}_2}{3 \text{ mol O}_2} \left| \frac{2 \text{ mol NaClO}_3}{1 \text{ mol NaClO}_3} \right| \left| \frac{106.44 \text{ g NaClO}_3}{1 \text{ mol NaClO}_3} \right| = 0.158 \text{ g NaClO}_3$$

$$\frac{0.158 \text{ g NaClO}_3}{0.8765 \text{ g mixture}} \times 100 = 18.0\% \text{ NaClO}_3$$



$$109) \quad P_{\text{N}_2} = 726 - 23.8 \text{ torr} = 702.2 \text{ torr} = 0.924 \text{ atm}$$

$$PV = nRT$$

$$(0.924) 0.0318 = n(0.08206)298$$

$$n = \frac{0.00120 \text{ mol N}_2}{1 \text{ mol N}_2} \left| \frac{28.02 \text{ g N}_2}{1 \text{ mol N}_2} \right| = \frac{0.03367 \text{ g N}_2}{0.253 \text{ g compound}} \times 100 = 13.3\% \text{ N}$$